

DOCUMENT RESUME

ED 370 565

IR 055 018

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TITLE Exploring the Hyper-Environment for Elementary Children.
PUB DATE 93
NOTE 8p.; In: Visual Literacy in the Digital Age: Selected Readings from the Annual Conference of the International Visual Literacy Association (25th, Rochester, New York, October 13-17, 1993); see IR 055 055.
PUB TYPE Reports -- Research/Technical (143) -- Speeches/Conference Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Case Studies; Comparative Analysis; *Computer Assisted Instruction; Computer Software Development; Cooperative Learning; Courseware; Day Camp Programs; Educational Media; Educational Technology; Elementary Education; Elementary School Science; *Hypermedia; *Instructional Design; Instructional Innovation; *Multimedia Instruction; Teaching Methods
IDENTIFIERS *Learning Environments; Multimedia Materials; *Multimedia Technology

ABSTRACT

Educators working with elementary school children need to consider the impact of unstructured and structured hypermedia on the learning occurring in computer-assisted instruction. This paper discusses a case study of a collaborative group of four boys during a summer science camp. Their interactions with two different examples of hypermedia are observed. One program was a structured hypermedia approach that provided a framework for exploring videodisc information while exploring a hands-on activity. The second program was an unstructured hypermedia environment. The children used the hypermedia in different ways: with the unstructured hyper-environment, the children were satisfied to rely on visuals to gain information; with the structured hyper-environment, the children worked through the activity using the steps followed in the program. Teachers wanting to use the hyper-environment as a way to explore hands-on investigations using the computer should look for structured hypermedia programs. (Contains 6 references.) (JLB)

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Exploring the Hyper-Environment for Elementary Children

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Exploring the Hyper-Environment for Elementary Children

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The hyper-environment is changing the way we access information via technology. It allows information access along non-linear pathways (Horn, 1989, Locatis, Letourneau, & Banvard, 1989). This format permits the learner to access information (text or visual) using the conceptual framework that the learner brings to the task. By constructing knowledge based on learner connections the knowledge gained is more meaningful.

Those providing computer-based instruction need to be aware of the various forms of hypermedia instruction (Jonassen & Grabinger, 1990). Educators working with elementary children need to consider the impact of unstructured hypermedia and structured hypermedia on the learning taking place during computer-assisted instruction. It is very easy for learners to become disoriented within the hyper-environment unless their ability to focus on context is very strong (Jih & Reeves, 1992).

This paper will discuss a case study of one collaborative group of four boys during a summer science and technology camp. Their interactions and reactions with two different examples of computer-based hypermedia will be discussed.

SCI-TECH Camp

For the past two summers Northern Illinois University has entered into cosponsorship with Encyclopaedia Britannica Educational Corporation to present a hands-on science camp to elementary school children entitled SCI-TECH Camp. During the summer of 1992 the camp was a beta-pilot of the newly created Britannica Science System (BSS). BSS was a combination of two separate science programs. The first was Full Option Science System (FOSS), a hands-on approach to teaching science developed at the Lawrence Hall of Science through an NSF grant. The second was Britannica's Science Essentials, originally a videotape series (now on videodisc) of information and hands-on science activities for elementary children.

The half-day camp was designed to provide elementary children (grades 3-4 am and grades 5-6 pm) with opportunities to explore science content via hands-on investigations and multimedia materials. The children explored topics including electricity and magnetism, human body, levers and pulleys, and solar energy. Daily each child had the opportunity to select one of the topics for the day's investigation.

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During the 1992 camp we observed that the children would utilize the computer-based hypermedia as a discrete form of instruction regardless of the setting surrounding the use of the computer. The children were not likely to begin a hands-on investigation and then refer to related material on the hypermedia until they had completed the investigation. Nor did the children observe a hands-on investigation on the videodisc and then ask to actually perform the investigation, even though the materials were readily available.

As we reflected on the 1992 camp several questions emerged regarding the children's use of hypermedia. How do children use the hyper-environment for instruction? Is their learning effective? Do they possess the cognitive skills necessary to create meaning? Who is the mediated instruction for? Is it for the children who are to learn from it or the adults who purchase it? Based on the casual observations of the 1992 camp we planned to observe the student's use of hypermedia more closely during the summer camp of 1993.

The Computer-Based Hypermedia Programs

The camp staff was charged with developing a camp curriculum that would allow children to explore science using hands-on elements combined with hypermedia. To respond to that requirement a rapid prototype for a computer-based hypermedia environment was developed that was responsive to the need to provide learner guidance yet allow for exploration. This prototype was developed independent of the materials supplied with Science Essentials. Due to the limited lead-time for developing the camp curriculum the prototype was abandoned for the 1992 camp. However, the skeletal

framework was in place prior to viewing the Science Essentials hypermedia material.

During the fall of 1992 and the spring of 1993 the investigation-based prototype was developed. This format used a structured hypermedia approach to provide children with a framework for exploring the videodisc information while exploring a hands-on activity. The program, hereafter referred to as Program A, was developed using LinkWay. Early screens provided information to the learner about identifying the proper videodisc, how to use the cursor to guide the computer, and how to initialize the videodisc player as shown in figure 1.

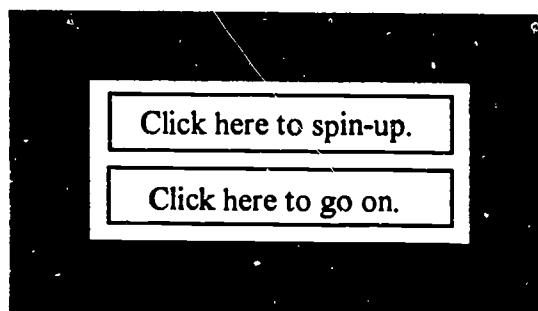
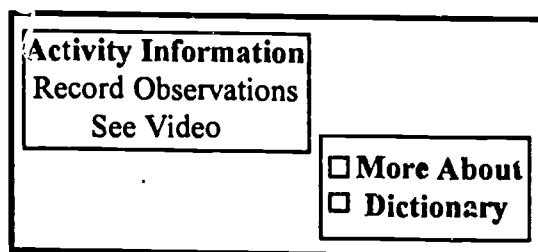


Figure 1. Initializing Player

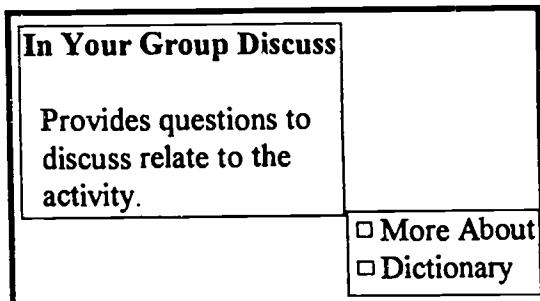
Once the activity was accessed the learner or collaborative group was guided through the activity. The instructions told the learner what equipment was needed for the activity along with the required *Think Sheet*. This information could be accessed visually by clicking on the *See Video* icon as shown in figure 2.



Also included navigation and help.

Figure 2. Activity Instructions

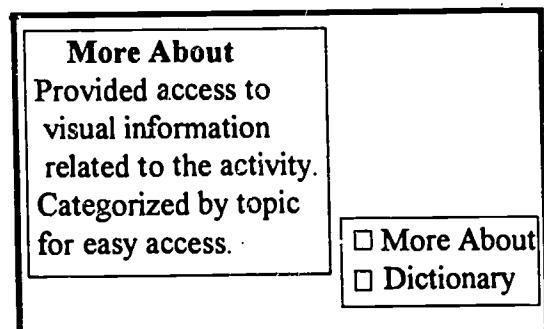
The learner(s) were guided through the activity by combining visual and text information. Discussion points were built into the program to encourage discussion among the learners as shown in figure 3.



Also included navigation and help.

Figure 3. Discussion Points

At any point throughout the activity the learner could access a section entitled *More About* as shown in figure 4.

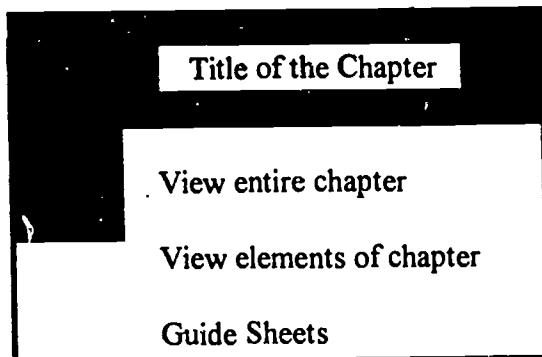


Upon closing the user returned to the spot in the activity they left.

Figure 4. More About

This section provided a visual database of information contained in the videodisc related to the activity topic. In addition a dictionary was available from any activity screen. The dictionary contained definitions of key words related to the activity as well as a visual explanation of the word or word group. Each screen provided navigational and help information as well.

The second program, hereafter referred to as Program B, was developed on HyperCard. The early screens provided directories for multiple ways to access the disc information including: by title, by scientific theme, and by index. There was a single screen related to each specific activity or topic (as shown in figure 5), providing an unstructured hypermedia environment.



Also included: navigational information, glossary, help, access to a notebook, play video & make video clip commands.

Figure 5. Single Screen Format

Each videodisc contained four chapters so there were four discrete screens per disc. Each discrete screen provided video access so the learner could see the entire chapter including the lesson, or view informative segments (similar to the *More About* in Program A), or view the *Think Sheets* for the activity. In addition, Program B featured an option to access an online notebook and provided the opportunity to create barcodes of specified videoclips. The glossary contained definitions of key words related to the activity chapter including an audio pronunciation of the word. Each screen provided navigational and help information as well.

Camp Setting

The camp took place in the Science Education Center at Northern Illinois University. This facility housed the elementary science education materials for the university. In addition, instructional and reference materials, science equipment and supplies were located in this facility. A portion of the facility also served as the classroom area for science education instruction.

The classroom was large and invited investigation. Each of the six tables in the classroom was surrounded by six chairs. The worktables were large enough to allow for individual work areas yet small enough to allow group work that encouraged collaboration. The classroom also had spacious ledges surrounding the instruction area and five large sinks were available in the room. The work area was well lit by natural and artificial light sources. Plants hung in the windows and there were several animals that were residents in the facility.

Several College of Education departments teamed together to provide sufficient equipment for the camp participants. During the camp of 1993 there were two DOS platforms complete with videodisc players connected. One of the DOS platforms also supported a CD-ROM with Comptor's Multimedia Encyclopedia. In addition, two MAC platforms complete with videodisc players were also available. A third DOS platform was available to the camp staff, but was not used. There was also a videodisc player with a monitor in the room. This station was used by the children via a barcode reader.

The campers attended in the morning (grades 3-4) or in the afternoon (grades 5-6). Upon their arrival the campers worked on a large group hands-on science project

that was designed to last over the entire week. This was a common topic to all participants. After about one hour the campers began to work on their specific projects. The afternoon campers were able to choose between two topics: Landforms and Levers and Pulleys. The levers and pulleys campers were the children observed for this study. The specific projects focused on a problem requiring a solution proposal by the end of the week of camp. These problems were carefully designed to combine hands-on investigations with multimedia materials.

Observations of the Campers

The enrollment for SCI-TECH Camp's afternoon session was very small in 1993. A total of 8 children attended, seven male and one female. The collaborative group ($N=4$) that was observed were all male and had completed the fifth grade. Their topic of study was levers and pulleys.

On Wednesday the children were provided the opportunity to work with Program B. On Thursday the children worked with Program A. Both programs were based on the videodisc entitled *Simple Machines and Motion* from BSS. Each day they were instructed how to work with the computer-based hypermedia program and were then left alone to work. That is, they controlled the decision-making process, asked the questions, and determined the course of the multimedia use. A camp staff member remained with them to assist them if necessary.

On Wednesday when the children used Program B they used the hyper-environment strictly to view the visual material. When they were done viewing they did not pursue the activity ideas further. When they had viewed the entire chapter and the ele-

ments of the chapter they were done. If they viewed material that they had already seen several stated, "We've seen that already," and went on to another element of the chapter. They collaborated on accessing the information.

On Thursday when the children used Program A their work was more integrated. Since the program centered around a specific activity they seemed to work through the steps of the activity, following the direction of the program. While they could have gone on through the program without performing the steps in the activity they did not. When they got to the first screen that directed them to perform the first step of the activity they sat there several seconds then one of them said, "Oh," and went over to the table and began to set-up the investigation. The others followed and watched. After the second screen which gave more information about the activity the others joined in the investigation. They did not explore the database of information until they had completed all the steps to the activity.

Discussion

The children we observed did use the hyper-environments in two different ways. In Program B which tended toward a more typical hyper-environment the children were satisfied to rely on visuals to gain information. As one participant said, "I'd rather just watch the disc. Well, the activities were interesting to try, but I liked to sit lazily watching the disc. It was more entertaining..." Another said, "I'd rather use the computer. Using computers gets my full attention, just because it keeps my attention." One student stated, "I wanted to do the activity I saw, but I didn't think about

doing it when we were done [viewing the computer material]."

When they used Program A the children worked through the activity following the steps provided in the program. They combined the hands-on with the visual information. Upon completion of the activity they used the resource materials to supplement what they had done. As one participant said, "It was more helpful to use the computer and then the hands-on." Another stated, "I'd rather the computer told me what to do then go back and do a little more [of the activity], but not isolated doing one thing or another, but doing both." One child summed up his attitude toward using computers by stating, "Yes, it was helpful to have the computer give directions. I like to be told by a person, but the computer is just fine with me."

Our case study points to the importance of examining the use of the hyper-environment with elementary age children. Based on our observations if teachers want to use the hyper-environment as a way to explore hands-on investigations using the computer as a resource then it appeared that Program A was more successful in integrating the two. Further work in this area needs to be encouraged.

We identified many unanswered questions during our observations. Some of them follow. Do developers of multimedia need to consider the developmental level of the learner when creating hypermedia software for elementary children? Do teachers have enough expertise in media evaluation to make good selections regarding the materials they purchase? Is hypermedia purchased, for the type of learning that is expected to occur? How can effective hypermedia instruction be created for the

early elementary learner? What learner control elements must be present to help early elementary learners learn effectively from a hyper-environment?

Regardless of the questions raised, either platform provided the campers with a rich visual environment in which to work. The children gained from their observations far more than by simply using text. How they used that information becomes the question. Was it to understand scientific inquiry or to be "entertained"?

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